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The Impact of Aid for Trade on Product Diversification: An Empirical Analysis on the Extensive Margin of International Trade[1]

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製品の多様化に対する貿易のための援助の影響
― 国際貿易の外延に関する実証分析 ―

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Abstract

Foreign aid is highly related to the economic development of developing nations. Regardless of the mixed results given in the past literature, policymakers acknowledge the importance of foreign aid in the international society. This research focuses on the effectiveness of Aid for Trade (AFT), a part of Official Development Assistance (ODA) designated to facilitate international trade. As product concentration has always been a significant problem for aid recipients, we have examined whether AFT has contributed to the export diversification of developing nations. We constructed an extensive margin of international trade based on the number of products among sectors. We used the Poisson pseudo maximum likelihood (PPML) estimator to adjust for zero-trade observations and possible heteroskedasticity. The results indicate that AFT effectively improves product diversification of aid recipients compared to other foreign aid. Further, we have confirmed the appropriate usage of other foreign aid by the aid recipients; they do not limit trade relationships with aid donors, and comply with the non-economic and non-political characteristics of foreign aid supported by the aid donors. Therefore, to facilitate the international export environment of developing nations, the donors need to consecutively support higher AFT rates, and the recipients need to support newly trading firms as well as firms already engaging in the foreign market to harmonize the international trade environment.

Key Words : aid for trade, foreign aid, product diversification, extensive and intensive margins of international trade, Poisson pseudo maximum likelihood
JEL Classification: F13; F14

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1. Introduction

The United Nations (UN) reached a consensus regarding a new sustainable development agenda on 25th September 2015. Countries seeking the concurrent prosperity of the entire world assembled a set of objectives to determine the sustainable development goals (SDGs). The notable roles of effectuating the agenda include building resilient infrastructure, promoting resolute industrialization, revitalizing global partnerships, and mobilizing finances. Creating an environment to act as the vanguard for the sustainable economic development of developing nations was highly encouraged.[2]

Foreign aid is highly related to the economic development of developing nations. The establishment of the Development Assistance Committee (DAC) facilitated foreign aid flow to developing nations to achieve sustainable economic development. Strands of literature show a favorable impact of foreign aid on the economic growth of developing nations (e.g., Burnside and Dollar, 2000; Durbarry et al., 1998; Gupta and Islam, 2012). Rajan and Subramanian (2008), on the other hand, argued that the impact of foreign aid on economic growth is vague and not robust. Regardless of the mixed results, the effectiveness of foreign aid is getting more attention.

International trade is one of the criteria for evaluating economic development and has been contributing to the rapid economic growth of developing nations. According to the World Bank (1993, p.22), export-related regimes supported the rise of "four tigers": Hong Kong, Singapore, South Korea (hereafter, Korea), and Taiwan. Moreover, the currently fragmented global value chains (GVCs) and supply chains substantiate the importance of international trade. Therefore, this paper focuses on how foreign aid stimulated or hampered the exports of the developing nations, considering that exports play a significant role in economic growth.

Of the various foreign aid avenues, we focus on the Aid for Trade (AFT). Paris Declaration on Aid Effectiveness first employed the term AFT in 2005 and emphasized the recipients' local ownership of foreign aid. The primary objectives of AFT include not only technical assistance for trade-related needs but also capacity building of productive economic infrastructure, which allows aid recipients to independently and actively participate in the current globalized world. Therefore, we conducted an empirical analysis to find out whether AFT effectively performs its role to stimulate international trade and facilitate the trade environment of aid recipients.

Developing nations often suffer from export concentration. According to the OECD/WTO (2017, p.312), most recipients pick export diversification as a priority for enhancing the international trade environment as they face severe export concentration. Accordingly, our research aimed to explore the following: First, through which channels do AFT facilitate international trade. The OECD/WTO (2019, p. 35) reports that export diversification among sectors follows the international trade flow trend. Helpman et al. (2008) also stressed upon the importance of the number of exported goods or exporters, for the appropriate calibration of international trade flow; the number of exported goods or exporters is defined as the extensive margin of international trade. Thus, we used the extensive margin of international trade to represent export diversification and empirically test whether AFT

facilitates product diversification.

Following Chaney (2008) and Lawless and Whelan (2007), we construct the extensive margin as the number of products traded. Various studies have attempted to calibrate the extensive margin of international trade. Feenstra (1994) and Hummels and Klenow (2005) determined the extensive margin as the weighted number of a specific country's exported products relative to the categories exported by the total sample countries. Helpman et al. (2008) considered the number of sectors or goods traded as an extensive margin using the standard two-stage Heckman selection to control for selection bias, following Heckman (1979). As our analysis employed different sample countries depending on the aid donors and recipients, we used a simple measure of number of the exported goods as the extensive margin of international trade rather than the weighted measure. Moreover, instead of using the two-stage Heckman selection model to account for selection bias, which involves zero trade value, we used the Poisson pseudo maximum likelihood (PPML) estimation suggested by Silva and Tenreyro (2006), which is effective in accounting for both zero trade value and possible heteroskedasticity.

Although we focused primarily on the extensive margin of international trade, we also included the intensive margin of international trade. International trade is often decomposed as the extensive and intensive margins, where the former implies the number of goods traded, and the latter implies the value of exports per good. Exploring both the margins could give insights to the channels that AFT influences on the international trade flow.

Second, we have evaluated the effectiveness of AFT on product diversification by comparing it with the impact of other foreign aids on international trade. The results indicate that AFT is more effective in increasing the product diversification of developing nations than other aids.

The rest of the paper is structured as follows. In section 2, we present the past literature related to our research. Sections 3 and 4 describe the data and research methodology. Section 5 presents the empirical results. We conclude our research with section 6.

2. Literature Review

Numerous past studies have dealt with the impact of foreign aid on international trade. Lloyd, McGillivray et al. (2000) argued that the relationship between foreign aid and trade is ambiguous. They examined the foreign aid flow of four European donors to 26 African recipients from 1969 to 1995 and showed that the relationship between aid and trade is not robust. On the other hand, the majority of the literature confirms the positive impact of foreign aid on international trade flow. Pettersson and Johansson (2011) used the gravity model from 1990 to 2005 for 184 sample countries to show that foreign aid positively affects exports not only from the donors but also from recipients to their partners. The Heckman selection model showed that the aid relationship lowers the fixed costs of trade relationships, usually defined as distance. Wagner (2003) also addressed the positive link between foreign aid and exports. The ordinary least squares (OLS) and maximum likelihood estimation (MLE) results suggest that the relationship between aid and trade is larger than those

predicted by official documents.

The 2005 Paris Declaration drove scholars to actively participate in the evaluation of AFT. The result generally indicated that AFT positively impacts international trade flow. Cali et al. (2011), and Ghimire et al. (2013) used sector-level data and regional-level data, respectively, to show positive relationships between AFT and the exports of both the donors and recipients.[3] Hühne et al. (2014) also found that AFT increases bilateral exports between the donors and recipients. They performed generalized method of moments (GMM) estimation for all aid donors and recipients from 1990 to 2010 period to show that the share of benefits that donor nations get from AFT is larger than those of the recipient nations. Ghimire et al. (2013) employed the seemingly unrelated regression (SUR) method with 121 AFT recipients over the 1995-2010 period to show that AFT provides positive and statistically significant results for all sectors. Ghimire et al. (2016) used the system GMM estimation to evaluate how AFT has assisted the export performance of recipient nations. The results showed a significant effect of AFT on export performance of recipient nations, which was in line with their previous research. However, the magnitude was low, suggesting AFT plays a limited role on the aid recipients. Wagner (2003) also emphasized the restricted role of AFT on exports. Nevertheless, as Helpman et al. (2008) stated, the traditional estimates of international trade are often biased as they often ignore diversification of products when considering international trade flow. Therefore, we decompose international trade into the extensive and intensive margins to thoroughly examine the effect of foreign aid.

Only a handful of past literature focused on the impact of AFT on the diversification of exported goods. Kim (2012) used the Herfindahl-Hirschman index (HHI) as a dependent variable to define product concentration and examined AFT's impact on product diversification by performing system GMM. She separated AFT into three categories and concluded that building productive capacity significantly benefited product diversification. She considered the time difference between receiving foreign aid and implementing disbursement in local trade-related sectors by employing lagged AFT variables. HHI is useful in examining the market share among the whole traded goods. Our research, however, focuses on product diversification for each sector. Unlike the previous analysis of the product diversification of whole sectors using HHI, we have focused on the extensive margin of international trade, which constitutes the product variation in each sector. Traditional theory of comparative advantage by Ricardo shows that countries have strength in the productivity of specific sectors, and focusing on the production of products in those sectors and products will result in a larger benefit as they can import other goods for relatively less productive sectors. Therefore, we focused on the impact of AFT on product diversification via the extensive margin of international trade. Furthermore, comparison on the effects toward extensive and intensive margins can show the direction of AFT on the international trade.

3. Data

3.1 Variables for Aid for Trade

AFT was established with the Paris Declaration—it is not a new aid category nor a new type of global development fund.[4] Donors have provided substantial amounts of trade-related aid to recipient nations in various sectors: Building trade capacity, enhancing growth prospects, and even reducing poverty. According to the WTO Trade Capacity Building Database (2006, p.1), "Aid for Trade is about assisting developing countries to increase exports of goods and services, to integrate into the multilateral trading system, and to benefit from liberalized trade and increased market access." AFT particularly comprises "Technical assistance for trade policy and regulations," "Economic infrastructure," "Productive capacity building," "Trade-related adjustment," and "Other trade-related needs." For the purpose of this research, we narrowed down the categories of AFT. We extracted foreign aid data from the OECD Structural Analysis Database (STAN) Creditor Reporting System (CRS). According to OECD (n.d.), AFT includes "Technical assistance for trade policy and regulations," "Economic infrastructure," "Productive capacity building," "Trade-related adjustment," and "Other trade-related needs."

Table 1: Descriptions of AFT categories

	Contents	CRS code
Technical assistance for trade policy and regulations	Developing and negotiating trade agreements	33110, 33120, 33130, 33140, 33181
Economic infrastructure	Proxies for constructing infrastructure for trade	21010, 21020, 21030, 21040, 21050, 21061, 21081, 22010, 22020, 22030, 22040
Productive capacity building	Trade development via examination of comparative advantage of each country and diversifying corresponding products	24010, 24020, 24030, 24040, 24081, 25010, 25020, 31110, 31120, 31130, 31140, 31150, 31161, 31162, 31163, 31164, 31165, 31166, 31181, 31182, 31191, 31192, 31193, 31194, 31195, 31210, 31220, 31261, 31281, 31282, 31291, 31310, 31320, 31381, 31382, 31391, 32110, 32120, 32130, 32140, 32161, 32162, 32163, 32164, 32165, 32166, 32167, 32168, 32169, 32170, 32171, 32172, 32182, 32210, 32220, 32261, 32262, 32263, 32264, 32265, 32266, 32267, 32268, 33210
Trade-related adjustment	Alleviating trade costs such as tariff rates	33150
Other trade-related needs	Donor's intention of aids which cannot be gleaned	N/A

Source: Author's arrangement based on OECD (n.d.).

Table 1 shows the five categories of AFT and corresponding CRS codes.[5] OECD collects the ODA data throughout each year, aggregates the ODA data by April, separates the data for each project by December, and then revises the past ODA data by June and September (OECD, n.d.). It is the only source of publicly available ODA data. Each category is closely related to facilitating the trade environment of aid recipients. AFT data are not collected separately but incorporate specific ODA categories that directly affect international trade. We summed all the real disbursement values reported as AFT and deflated them via constant 2010, thousand USD. As the disbursement value includes a negative value, wherein the loan payback of aid recipients is larger than AFT, we normalized the value using the zero-to-one scale. The OECD database keeps track of the loan payback separately for each CRS code. As the current study focuses on the actual usage of foreign aid by the aid recipients, we used the total disbursement value, which takes account of the loan payback.

We employed four variables to represent foreign aid in this research. First, we summed all the ODA values to examine the total effect of ODA on international trade. Second, among the ODA, we distinguished AFT and non-AFT variables to determine whether AFT plays a significant role in increasing international trade compared to other ODA. Specifically, we compared the effectiveness of AFT with other ODA. Finally, we considered foreign aid other than ODA to compare their effects with that of ODA.

Table 2: Sample countries

	ISO3	Total
Only DAC	AUS, AUT, BEL, CAN, CHE, CZE, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, IRL, ISL, ITA, JPN, LUX, NLD, NOR, NZL, POL PRT, SVK, SWE, USA	27
DAC that were also recipients	KOR, SVN	2
Donors other than DAC	BGR, EST, LTU, LVA, ROU, RUS	6
Donors other than DAC that are also recipients	ARE, AZE, CYP, HRV, ISR, KAZ, KWT, MLT, SAU, THA, TUR	11
Only recipients	ABW, AFG, AGO, ALB, ARG, ARM, ATG, BDI, BEN, BFA, BGD, BHR, BHS, BIH, BLR, BLZ, BMU, BOL, BRA, BRB, BRN, BTN, BWA, CAF, CHL, CHN, CIV, CMR, COG, COL, COM, CPV, CRI, CUB, CYM, DJI, DMA, DOM, DZA, ECU, EGY, ERI, ETH, FJI, FSM, GAB, GEO, GHA, GIN, GMB, GNB, GNQ, GRD, GTM, GUY, HKG, HND, HTI, IDN, IND, IRN, IRQ, JAM, JOR, KEN, KGZ, KHM, KIR, KNA, LAO, LBN, LBR, LBY, LCA, LKA, LSO, MAC, MAR, MDA, MDG, MDV, MEX, MHL, MKD, MLI, MMR, MNG, MNP, MOZ, MRT, MUS, MWI, MYS, NAM, NER, NGA, NIC, NPL, NRU, OMN, PAK, PAN, PER, PHL, PLW, PNG, PRY, QAT, RWA, SDN, SEN, SGP, SLB, SLE, SLV, STP, SUR, SWZ, SYC, TCA, TCD, TGO, TJK, TKM, TON, TTO, TUN, TUV, TZA, UGA, UKR, URY, UZB, VCT, VEN, VNM, VUT, WSM, YEM, ZAF, ZMB, ZWE	142

Source: Author˙calculation on the number of countries and describing ISO3 codes based on UN Trade Statistics (n.d.). See https://unstats.un.org/unsd/tradekb/knowledgebase/country-code for more details.

Table 2 shows the total sample countries of this research. We have excluded EU institutions from the DAC members. Of the 188 total countries in the total sample, 35 countries are donors, and 155 countries are recipients. We first included all 188 samples bilaterally as reporters and partners, where reporters disburse foreign aid to the corresponding partners. We then restricted our sample with only the aid donors as reporters and aid recipients as partners. The former can evaluate the extensive and intensive margins of international trade of all recipients, while the latter can examine the extensive and intensive margins of international trade from the recipients to aid donors solely. We also conducted an empirical analysis using lagged foreign aid variables to check whether foreign aid takes time for the governments to implement.

3.2 Trade Data

We extracted the international trade value from UN Commodity Trade Statistics Database (COMTRADE) with HS 2002 nomenclature from 2010 to 2018. We deflated all the values using the constant 2010, thousand USD and further constructed the extensive margin of international trade as the number of HS 6-digit level products in HS 2-digit level sectors. We further constructed the intensive margin of international trade as the average traded value of each HS 2-digit level sector to distinguish whether AFT stimulated the number of new goods or the average value of incumbent exported goods. To meet the foreign aid variables, we aggregated the extensive and intensive margins of international trade using trade share.[6]

3.3 Other Data

We used the Free Trade Agreement (FTA) dummy, gross domestic product (GDP) per capita of donors and recipients, and distance as control variables. We extracted FTA relationships from the World Trade Organization (WTO) Regional Trade Agreement (RTA) database; the score of one implies the Preferential Trade Agreement (PTA) relationship between the donors and recipients, and zero implies that there is no relationship. The GDP per capita of our sample countries were also deflated using a GDP deflator with thousand USD as a unit. Both the GDP per capita and GDP deflator were from the World Development Indicator (WDI). Last, we obtained weighted distance information from Centre d' Études Prospectives et d' Informations Internationales (CEPII), where population information is used as a weight.

4. Methodology

4.1 Empirical Framework

This section provides regression equations for this research.

$$Margins_{jit} = f(X_{ijt}, Y_{ijt}) \tag{1}$$

Equation (1) shows the empirical framework of this research. $Margins_{jit}$ is a vector comprised of

IM_{jit} (intensive margin) and EM_{jit} (extensive margin). IM_{jit} refers to the average value of exports from the aid recipients j to aid donors i in time t, where j and i refers to 188 sample countries, and t is the year from 2010 to 2018. We also conducted empirical regression using j as 155 recipients and i as 35 donors.

EM_{jit}, on the other hand, denotes the number of products that are traded from j to i in time t. X_{ijt} is a vector for normalized foreign aid variables and Y_{ijt} is a vector for control variables including FTA dummy, GDP per capita of donors and recipients, and distance.

$$Margins_{jit} = TotalODA_{ijt} + OtherAid_{ijt} + FTA_{ijt} + lnGDPPC_{it} + lnGDPPC_{jt} + lnDistance_{ij} + \gamma_{ij} + \delta_{ijt} \quad (2)$$

$$Margins_{jit} = AFT_{ijt} + OtherODA_{ijt} + OtherAid_{ijt} + FTA_{ijt} + lnGDPPC_{it} + lnGDPPC_{jt} + lnDistance_{ij} + \gamma_{ij} + \delta_{ijt} \quad (3)$$

We expanded on equation (1) with equations (2) and (3). $TotalODA_{ijt}$ is the normalized value of total ODA from the aid donors i to recipients j in time t. We divide the total ODA ($TotalODA_{ijt}$) into the AFT, and ODA other than AFT denoted as AFT_{ijt} and $OtherODA_{ijt}$, respectively. $OtherAid_{ijt}$ reflects foreign aid other than ODA. FTA_{ijt} is the trade agreement relationship between i and j in time t. $lnGDPPC_{it}$, $lnGDPPC_{jt}$, and $lnDistance_{ij}$ are the natural logarithms of GDP per capita of the aid donors and recipients in time t, and the natural logarithm of the distance between the aid donors and recipients. γ_{ij} and δ_{ijt} are time-invariant and time-variant error terms, respectively.

$$Margins_{jit} = TotalODA_{ij,t-1} + OtherAid_{ij,t-1} + FTA_{ijt} + lnGDPPC_{it} + lnGDPPC_{jt} + lnDistance_{ij} + \gamma_{ij} + \delta_{ijt} \quad (4)$$

$$Margins_{jit} = AFT_{ij,t-1} + OtherODA_{ij,t-1} + OtherAid_{ij,t-1} + FTA_{ijt} + lnGDPPC_{it} + lnGDPPC_{jt} + lnDistance_{ij} + \gamma_{ij} + \delta_{ijt} \quad (5)$$

The majority of the past literature takes account of the different enactment times for foreign aid. As the actual usage of foreign aid often faces some time, the impact of foreign aid may also take some time before the tangible repercussion. Therefore, we used lagged aid variables with $t-1$, as shown in equations (4) and (5) for robustness check.

We used PPML to examine the impact of AFT on the two margins of international trade. Silva and Tenreyro (2006) stated that PPML effectively adjusts for zero trade value and heteroscedasticity. As our dependent variables, the extensive and intensive margins of international trade possess zero value, meaning that neither products nor trade value were reported, we used PPML to adjust for zero observations. We controlled for country and year-fixed effect for all the regressions.

4.2 Pre-regression Statistics

Tables 3 to 6 provides the summary statistics for each of our samples. All the variables denote raw values before the transformation, except for the ODA variables with "(Normalized)" at the end of the variable—they indicate the normalized values of ODA variables constructed using the zero-to-one scale. As discussed in section 3, The unit of variables related to international trade, foreign aid, and GDP per capita, is thousand US dollar[7].

Table 3: Summary statistics (Total sample)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	Mean	SD	Min	Max
Extensive Margin	231,268	23.98	116.0	0	18,656
Intensive Margin	231,268	3.466e+07	6.248e+09	0	2.247e+12
Total ODA (Raw)	231,268	16,246	3.859e+06	−8.629e+08	7.810e+08
AFT (Raw)	231,268	21,515	2.234e+06	−180,608	5.670e+08
ODA other than AFT (Raw)	231,268	15,593	4.152e+06	−8.629e+08	1.034e+09
Other foreign aid (Raw)	231,268	1,163	145,095	−3.742e+07	3.161e+07
FTA	231,268	0.168	0.374	0	1
GDP per capita (Donor)	231,268	16.49	21.19	0.234	118.8
GDP per capita (Recipient)	231,268	16.57	21.20	0.234	118.8
Distance	231,268	7,457	4,398	60.77	19,667
Total ODA (Normalized)	231,268	0.525	0.00235	0	1
AFT (Normalized)	231,268	0.000356	0.00394	0	1
ODA other than AFT (Normalized)	231,268	0.455	0.00219	0	1
Other foreign aid (Normalized)	231,268	0.542	0.00210	0	1

Table 4: Summary statistics (Total sample with lagged foreign aid variables)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	Mean	SD	Min	Max
Extensive Margin	200,049	24.57	119.6	0	18,656
Intensive Margin	200,049	3.532e+07	6.596e+09	0	2.247e+12
Total ODA (Raw, t-1)	200,049	16,630	3.840e+06	−8.629e+08	7.810e+08
AFT (Raw, t-1)	200,049	22,567	2.378e+06	−180,608	5.670e+08
ODA other than AFT (Raw, t-1)	200,049	17,496	4.240e+06	−8.629e+08	1.034e+09
Other foreign aid (Raw, t-1)	200,049	1,114	150,453	−3.742e+07	3.161e+07
FTA	200,049	0.173	0.378	0	1
GDP per capita (Donor)	200,049	16.64	21.24	0.234	118.8
GDP per capita (Recipient)	200,049	16.74	21.25	0.234	118.8
Distance	200,049	7,403	4,387	60.77	19,650
Total ODA (Normalized, t-1)	200,049	0.525	0.00228	0	0.925
AFT (Normalized, t-1)	200,049	0.000357	0.00389	8.26e−05	1
ODA other than AFT (Normalized, t-1)	200,049	0.455	0.00226	0	1
Other foreign aid (Normalized, t-1)	200,049	0.542	0.00200	0	0.924

Table 5: Summary statistics (Aid donors to recipients)

VARIABLES	(1) N	(2) Mean	(3) SD	(4) Min	(5) Max
Extensive Margin	57,371	19.51	64.66	0	4,274
Intensive Margin	57,371	1.865e+07	1.413e+09	0	2.859e+11
Total ODA (Raw)	57,371	65,488	7.748e+06	−8.629e+08	7.810e+08
AFT (Raw)	57,371	86,730	4.486e+06	−180,608	5.670e+08
ODA other than AFT (Raw)	57,371	62,858	8.335e+06	−8.629e+08	1.034e+09
Other foreign aid (Raw)	57,371	4,687	291,289	−3.742e+07	3.161e+07
FTA	57,371	0.0695	0.254	0	1
GDP per capita (Donor)	57,371	35.96	22.89	3.881	118.8
GDP per capita (Recipient)	57,371	9.251	14.17	0.234	93.78
Distance	57,371	7,409	3,874	114.6	19,564
Total ODA (Normalized)	57,371	0.525	0.00471	0	1
AFT (Normalized)	57,371	0.000471	0.00791	0	1
ODA other than AFT (Normalized)	57,371	0.455	0.00439	0	1
Other foreign aid (Normalized)	57,371	0.542	0.00422	0	1

Table 6: Summary statistics (DAC to recipients)

VARIABLES	(1) N	(2) Mean	(3) SD	(4) Min	(5) Max
Extensive Margin	38,060	19.68	48.73	0	2,032
Intensive Margin	38,060	9.077e+06	5.638e+08	0	8.541e+10
Total ODA (Raw)	38,060	20,011	7.844e+06	−8.629e+08	6.585e+08
AFT (Raw)	38,060	99,106	4.78e+06	−180,608	5.67e+08
ODA other than AFT (Raw)	38,060	37,063	9.406e+06	−8.629e+08	1.034e+09
Other foreign aid (Raw)	38,060	7,065	357,610	−3.742e+07	3.161e+07
FTA	38,060	0.0639	0.245	0	1
GDP per capita (Donor)	38,060	44.70	22.24	12.43	118.8
GDP per capita (Recipient)	38,060	9.238	14.22	0.234	93.78
Distance	38,060	7,722	3,813	180.3	19,564
Total ODA (Normalized)	38,060	0.525	0.00477	0	0.925
AFT (Normalized)	38,060	0.000493	0.00843	0	1
ODA other than AFT (Normalized)	38,060	0.455	0.00496	0	1
Other foreign aid (Normalized)	38,060	0.542	0.00518	0	1

Note: For Table 3 to 6, N refers to the total observations, SD refers to the standard deviation, Min refers to the minimum value, and Max refers to the maximum value.
Source: Author's calculation

As the majority of the countries in our sample are aid recipients, the FTA relationship is scarce. Total ODA refers to the sum of all the ODA, including AFT. We then divided total ODA into two categories: (i) AFT and (ii) ODA other than AFT. Another foreign aid type is foreign aid without ODA. Foreign aid variables" with (t-1)" are lagged variables. Table 5 shows the summary statistics

using the sample of aid donors as the only *i* and aid recipients as the only *j*. We analyzed the sample to determine if the product diversification of developing nations is restricted to the aid donors alone or is expanded to other counterparts as well. We determined that if the result shows only statistically significant and positive coefficients for the samples of table 5, foreign aid largely induces international trade from the aid recipients to aid donors. Samples in Table 6 are of only the DAC nations, denoted as *i*.

5. Result

In this section, we present the PPML results for equations (2), (3), (4), and (5) with different samples. GDPPC indicates GDP per capita.

Table 7: PPML results using the total sample

VARIABLES	(2) Extensive Margin	(3) Extensive Margin	(2) Intensive Margin	(3) Intensive Margin
Total ODA	1.846***		20.527**	
	−0.564		(10.025)	
AFT		1.709***		−135.328
		(0.228)		(356.792)
ODA other than AFT		1.108		21.226*
		(0.829)		(11.229)
Other foreign aid	−3.326	−3.323	4.972	4.963
	(2.508)	(2.510)	(6.231)	(6.269)
FTA	0.060	0.060	−0.791	−0.784
	(0.063)	(0.063)	(0.803)	(0.800)
Log of GDPPC (Donor)	0.153*	0.152*	−0.220	−0.223
	(0.092)	(0.092)	(3.922)	(3.923)
Log of GDPPC (Recipient)	0.528***	0.527***	−0.846	−0.847
	(0.084)	(0.084)	(1.403)	(1.404)
Log of Distance	−0.320***	−0.320***	2.178***	2.171***
	(0.034)	(0.034)	(0.759)	(0.756)
Constant	3.446**	3.912**	−12.161	−10.922
	(1.513)	(1.532)	(21.118)	(20.930)
Observations	231,268	231,268	231,268	231,268
R-squared	0.150	0.150	0.554	0.553
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Log Likelihood	−3.790e+06	−3.789e+06	−1.860e+13	−1.860e+13

Robust standard errors in parentheses
***p<0.01, **p<0.05, *p<0.1

Table 7 shows the PPML results using the total sample for equations (2) and (3). The numbers in the parentheses at the top of the table refer to the equation number, and "Extensive Margin" and "Intensive Margin" denote the dependent variables. All the results are fixed effects using country dummies and year dummies. The results show that total ODA positively affects both the number of products traded (extensive margin) and the average value of exports (intensive margin) with statistical significance. The total disbursement of ODA contributes to the product diversification of aid recipients.

Moreover, AFT positively and statistically significantly contributes to product diversification,

whereas it has an insignificant relationship with the average value of incumbent goods (intensive margin). ODA other than AFT, on the other hand, encourages the average value of exports but with a low rate of statistical significance. Foreign aid other than ODA shows no statistically significant results. The results indicate that AFT diversifies the overall exported goods of 188 sample countries. Compared to other foreign aid, AFT is effective in diversifying the products of the aid recipients, and the impact of AFT is not restricted to the aid donors alone. Therefore, AFT contributes to the aid recipients by diversifying the products of aid recipients.

Unlike the past empirical literature between trade costs and international trade, distance and FTA show counter-intuitive results. Distance shows positive coefficients on the intensive margin of international trade. As distance does not change over years, traditional empirical trade literature often uses distance as a part of fixed costs or iceberg costs. Lawless and Whelan (2007) theoretically suggested a positive relationship between fixed costs and the intensive margin of international trade. Bernard et al. (2007) empirically showed the positive link between import value per product per firm and distance. As fixed costs increase, firms need to export greater volume of incumbent goods (intensive margin) to gain profits in the designated markets, whereas new firms or products face a new threshold before participating in the foreign market. Firms with low-productivity will also exit the market as the fixed costs increase. As a result, the average volume of exports (intensive margin) increases.

Although statistically insignificant, FTA also shows a negative coefficient with the intensive margin of international trade. As shown in Table 3, the majority of the observations among the aid recipients in the FTA variable is zero. As most developing nations in our sample do not have FTA relationships, the impact of FTA on international trade may be marginal for developing nations. Developing nations need to construct international trade capacity and infrastructure to participate in the global market independently, prior to formulating bilateral or multilateral FTA relationships to enlarge the impact of FTA.

Table 8: PPML results using a total sample with lagged foreign aid

VARIABLES	(4) Extensive Margin	(5) Extensive Margin	(4) Intensive Margin	(5) Intensive Margin
Total ODA (t−1)	2.677***		16.443**	
	(0.549)		(8.271)	
AFT (t−1)		1.286***		−5.928
		(0.177)		(11.692)
ODA other than AFT (t−1)		2.338***		18.783**
		(0.356)		(9.429)
Other foreign aid (t−1)	−3.419	−3.418	10.178	10.179
	(2.100)	(2.101)	(10.674)	(10.667)
FTA	0.073	0.074	−1.085	−1.084
	(0.066)	(0.066)	(0.897)	(0.897)
Log of GDPPC (Donor)	0.221**	0.221**	0.271	0.271
	(0.092)	(0.092)	(3.773)	(3.773)
Log of GDPPC (Recipient)	0.530***	0.530***	−0.307	−0.308
	(0.084)	(0.084)	(1.590)	(1.590)
Log of Distance	−0.318***	−0.318***	2.824***	2.822***
	(0.034)	(0.034)	(0.884)	(0.883)
Constant	3.066**	3.407***	−17.753	−17.655
	(1.330)	(1.310)	(13.575)	(13.528)
Observations	200,049	200,049	200,049	200,049
R-squared	0.151	0.151	0.787	0.787
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Log Likelihood	−3.335e+06	−3.335e+06	−1.450e+13	−1.450e+13

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8 shows the PPML results using lagged foreign aid variables. Table 8 presents similar results to Table 7. ODA other than AFT needs implementation time compared to AFT, as they show high significant rates for Table 8 and also positive and statistically significant coefficients with the extensive margin of international trade. Taking into account the implementation period for the aid recipients to practice foreign aid, does not change the results. Each recipient government, therefore, estimates the volume of scheduled foreign aid and utilizes them readily with a limited implementation period.

Table 9: PPML results using donors and aid recipients

VARIABLES	(2) Extensive Margin	(3) Extensive Margin	(2) Intensive Margin	(3) Intensive Margin
Total ODA	0.886		−8.732**	
	(0.825)		(3.784)	
AFT		1.192***		−5,171.488
		(0.252)		(3,980.451)
ODA other than AFT		0.478		−11.535*
		(0.915)		(6.588)
Other foreign aid	−0.245	−0.240	−14.386***	−13.980***
	(1.643)	(1.645)	(3.432)	(3.140)
FTA	0.262***	0.262***	−0.027	0.023
	(0.077)	(0.077)	(0.873)	(0.858)
Log of GDPPC (Donor)	−0.773**	−0.778**	−2.349	−2.627
	(0.358)	(0.357)	(2.903)	(2.740)
Log of GDPPC (Recipient)	0.098	0.096	−0.094	−0.132
	(0.179)	(0.179)	(2.053)	(2.068)
Log of Distance	−0.134***	−0.134***	1.381*	1.433*
	(0.044)	(0.044)	(0.811)	(0.798)
Constant	3.119**	3.376**	12.027*	14.038*
	(1.318)	(1.326)	(6.802)	(7.305)
Observations	57,371	57,371	57,371	57,371
R-squared	0.271	0.272	0.663	0.670
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Log Likelihood	−657719	−657314	−2.390e+12	−2.370e+12

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: PPML results using DAC and aid recipients

VARIABLES	(2) Extensive Margin	(3) Extensive Margin	(2) Intensive Margin	(3) Intensive Margin
Total ODA	1.502		−16.865***	
	(1.123)		(5.305)	
AFT		1.208***		−347.518
		(0.160)		(691.971)
ODA other than AFT		1.057		−19.623***
		(0.947)		(6.182)
Other foreign aid	−1.183	−1.177	1.282	1.376
	(1.649)	(1.651)	(10.564)	(10.185)
FTA	0.123	0.126	−1.978*	−1.953*
	(0.104)	(0.104)	(1.089)	(1.077)
Log of GDPPC (Donor)	−0.056	−0.070	−4.551	−4.553
	(0.136)	(0.135)	(3.114)	(3.111)
Log of GDPPC (Recipient)	−0.166**	−0.168**	2.446	2.444
	(0.082)	(0.082)	(2.398)	(2.400)
Log of Distance	−0.256***	−0.256***	−2.392*	−2.371*
	(0.036)	(0.036)	(1.286)	(1.306)
Constant	2.451*	2.820**	70.164***	70.118***
	(1.271)	(1.207)	(22.271)	(22.352)
Observations	38,060	38,060	38,060	38,060
R-squared	0.400	0.402	0.533	0.532
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Log Likelihood	−366176	−365793	−7.550e+11	−7.540e+11

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9 shows the PPML results upon examining the relationship between the aid donors and aid recipients. As the donors increase AFT, the extensive margin of recipients increase too. However, the intensive margin of the aid recipients decreases as the total ODA increases. ODA other than AFT and other foreign aid also shows negative and statistically significant results, in contrast to Tables 7 and 8. That is, the aid recipients utilize foreign aid to increase the volume of exported goods (intensive margin) toward trade partners other than aid donors. This result complies with the objective of foreign aid to not have any economic or political purposes from the aid donors. Table 10 shows the PPML results upon examining the relationship between the DAC members and aid recipients. The results show similar outcome to Table 9. At all events, AFT contributes to the exports of aid recipients via product diversification.

6. Conclusion

We focused on the relationship between AFT and product diversification in this research. Unlike the past literature, we employed the extensive margin of international trade to determine whether AFT positively affects product diversification. The PPML results indicate that AFT positively and statistically significantly affects the extensive margin of international trade, regardless of the samples. AFT hardly showed statistically significant result on the intensive margin of international trade. As the priority of the aid recipients is the diversification of products, each government seems to concentrate AFT toward product diversification. Each government of the aid recipients appropriately utilizes foreign aid to firmly construct the trade infrastructure. Although ODA other than AFT and other foreign aid take time for their implementation, the aid recipients increased the intensive margin of international trade toward trade partners other than the aid donors.

As Helpman et al. (2008) addressed, analysis on international trade often ignores the extensive margin of international trade. Our study contributes to the trade literature on examining the relationship between foreign aid and international trade by including the product diversification.

Considering that we conducted country-level research, some shortcomings need to be noted, such as the limitations to the foreign aid data. We constructed a country-level extensive margin of international trade using the total trade share to meet the country-level foreign aid data provided by OECD STAN CRS. More disaggregated information on foreign aid may result in a sector-level analysis of the impact of foreign aid on the export performances of the recipient nations. Second, future research needs to take account of the different method for constructing the margins of international trade to see whether the impact of AFT or foreign aid shows similar results. These limitations need to be addressed by future research.

As AFT showed significant results related to product diversification, donors need to increase the ratio of AFT among ODA to facilitate the trade environment of recipient nations. On the other hand, recipient governments need to allocate subsidies to both newly trading firms and firms already in the foreign market to harmonize the extensive and intensive margins of international trade.

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Endnotes

[1] This research is based on: Kim (2018). *Effects of the "Aid for Trade" on Developing Nations: An Empirical Analysis on Export and Export Concentration.* Master's Thesis (Unpublished), Graduate School of Asia-Pacific Studies, Waseda University, Tokyo, Japan.

[2] See Goal 9 and Goal 17 from WTO (2015) for more details.

[3] The effects on the donors were larger than those on the recipients.

[4] See OECD (n.d.) for detailed information on ODA and the types of foreign aid. ODA need to meet specific objectives; being supplied by official agencies, having a specific goal as to assist the economic development of developing nations and being a concessional aid.

[5] OECD. (n.d.) discloses information on the foreign aid data including each CRS code. See https://www.oecd.org/development/financing-sustainable-development/development-finance-standards/dacandcrscodelists.htm for more details.

[6] Trade share refers to the total trade in a sector divided by total trade.

[7] Correlation among variables is very small. We provide the correlation matrix upon request.

References

Bernard, A. B., Jensen, J. B., Redding, S. J., and Schott, P. K. (2007). Firms in international trade. *Journal of Economic perspectives, 21*(3), 105-130.

Burnside, C., and Dollar, D. (2000). Aid, policies, and growth. *American economic review, 90*(4), 847-868.

Calì, M., Razzaque, M., and Velde, D. W. T. (2011). *Effectiveness of aid for trade in small and vulnerable economies: an empirical assessment.* Commonwealth Secretariat.

Chaney, T. (2008). Distorted gravity: the intensive and extensive margins of international trade. *American Economic Review, 98*(4), 1707-21.

Durbarry, R., Gemmell, N., and Greenaway, D. (1998). *New evidence on the impact of foreign aid on economic growth* (No. 98/8). CREDIT Research paper.

Feenstra, R. C. (1994). New product varieties and the measurement of international prices. *The American Economic Review*, 157-177.

Ghimire, S., Mukherjee, D., and Alvi, E. (2013). Sectoral aid-for-trade and sectoral exports: A seemingly unrelated regression analysis. *Economics Bulletin, 33*(4), 2756-2762.

Ghimire, S., Mukherjee, D., and Alvi, E. (2016). Aid-for-Trade and Export Performance of Developing Countries. *Applied Econometrics and International Development, 16*(1), 23-34.

Gupta, K. L., and Islam, M. A. (2012). *Foreign capital, savings and growth: An international cross-section study* (Vol. 9). Springer Science & Business Media.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica: Journal of the econometric society*, 153-161.

Helpman, E., Melitz, M., and Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The quarterly journal of economics, 123*(2), 441-487.

Hummels, D., and Klenow, P. J. (2005). The variety and quality of a nation's exports. *American Economic*

Review, 95(3), 704-723.

Hühne, P., Meyer, B., and Nunnenkamp, P. (2014). Who benefits from aid for trade? Comparing the effects on recipient versus donor exports. *The Journal of Development Studies, 50*(9), 1275-1288.

Jones, Y. M. (2013). Testing the foreign aid-led growth hypothesis in West Africa.

Kim, K. (2018). *Effects of the "Aid for Trade" on Developing Nations: An Empirical Analysis on Export and Export Concentration.* Master's Thesis (Unpublished), Graduate School of Asia-Pacific Studies, Waseda University, Tokyo, Japan.

Kim, Y. R. (2012). The effect of aid for trade on export diversification of recipient countries. In *15 th Annual Conf.* FREIT

Lawless, M., and Whelan, K. (2007). *A note on trade costs and distance.* Working Paper Series. UCD Centre for Economic Research.

Lloyd, T., McGillivray, M., Morrissey, O. and Osei, R. (2000). 'Does aid create trade? *European Journal of Development Research. 12*(1): 107-123

OECD. (n.d). *DAC and CRS code lists.* https://www.oecd.org/development/financing-sustainable-development/development-finance-standards/dacandcrscodelists.htm (Accessed 13th Dec. 2020)

OECD/WTO (2017), *Aid for Trade at a Glance 2017: Promoting Trade, Inclusiveness and Connectivity for Sustainable Development*, WTO, Geneva/OECD Publishing, Paris, https://doi.org/10.1787/aid_glance-2017-en.

OECD/WTO (2019), *Aid for Trade at a Glance 2019: Economic Diversification and Empowerment*, OECD Publishing, Paris, https://doi.org/10.1787/18ea27d8-en. (Accessed 27th Oct. 2020)

Pettersson, J. and Johansson, L. (2011). Aid, Aid for Trade, and Bilateral Trade: And Empirical Study. *The Journal of International Trade and Economic Development: An International and Comparative Review.* DOI:10.1080/09638199.2011.613998

Rajan, R. G., and Subramanian, A. (2008). Aid and growth: What does the cross-country evidence really show? *The Review of economics and Statistics, 90*(4), 643-665.

Silva, J. S., and Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics, 88*(4), 641-658.

UN Trade Statistics (n.d.). *Country Code.* https://unstats.un.org/unsd/tradekb/knowledgebase/country-code (Accessed 13th Dec. 2020)

Wagner, D. (2003). Aid and trade—an empirical study. *Journal of the Japanese and international economies, 17*(2), 153-173.

World Bank. (1993). *The East Asian miracle: Economic growth and public policy: Summary.* Washington, DC: World Bank.

WTO (2015). *Take Action for the Sustainable Development Goals. United Nations.* https://www.un.org/sustainabledevelopment/sustainable-development-goals/ (Accessed 29th Oct. 2020)

WTO Trade Capacity Building Database. (2006). Recommendations of the Task Force on Aid for Trade. https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4990.pdf (Accessed 23rd Oct. 2020)